

1: Introducing Longevity Antiaging Therapy

Longevity Physical Therapy is the premier physical therapy clinic in San Diego. We strive to restore function, enhance mobility, and amplify your performance. Physical therapy isn't just for recovering athletes; every person of every age can benefit from our services.

Making healthy lifestyle choices each day takes will power, persistence, and a lot of hard work. Optimum longevity is the end result of providing for all the needs of the whole person, consistently, over a very long period of time. Achieving a longer life requires that you take working on your health seriously. Great longevity is about a bunch of really old people living their lives. The oldest centenarians did nothing particularly special other than getting on with their lives. Some people have managed to age better than others have. We can all learn something important by looking closer at the elderly who have managed to age gracefully. Highlights of Longevity Antiaging Therapy: Natural health is anything but a quick fix cure for lifestyle diseases. Put off working on improving your health long enough and one day it might be too late to realistically start an antiaging therapy program. The Natural Health Perspective is a health, rather than a medical Web site. A natural health site should naturally offer a more commonsense approach to longevity. Therefore, no attempt will be made to offer medical approaches to a longer life. Making changes in lifestyle works! A study in the July 9, issue of Archives of Internal Medicine, published by the American Medical Association, provided the scientific proof. This study shows that populations that follow what they describe as healthy behaviors do live profoundly longer -- up to five and even ten years longer than those who do not. Most of those years are disability-free. Optimum longevity is about living a high quality of life for the longest time possible. It is not about hanging onto life, in some hospital bed, till the age of . The corollary to this principle is that if you have not yet died by the time you are 45, then you have been born with genetics that are more than adequate for a long life. The Natural Health Perspective wellness program, or natural therapies , provides the correct health fundamentals. Our antiaging therapy is grounded in the same five key areas required for optimum personal health. Optimum longevity requires that you take action. It requires that you take our health program seriously. When you have consistently carried out these health fundamentals over a long enough period of time, all the details will automatically take care of themselves. Many, but not all, pre-existing health conditions should self-correct. Stated in yet another way, your body will grow its way into a state of health provided you have consistently followed our anti-aging therapy over a long enough period of time. I will be writing only of real possibilities, consistent with the findings of medical science. But, achieving a longer life is the end result of a lot of hard work consistently applied over a very long period of time. Improving your longevity takes will power, persistence, and a lot of hard work; that only you can do. A hard fact of reality is that it can indeed be too late to start a longevity program of anti-aging therapy, or even a health program. So, if you want to start working on your health because you have recently been diagnosed with cancer, it might indeed be too late to expect natural health to miraculously save you overnight; after neglecting your health over a lifetime. Recall the Grasshopper and the Ant, childhood fable: An ant works hard in the heat all summer, building his house and laying up supplies for the winter. The grasshopper thinks he is a fool and laughs and dances and plays the summer away. Come winter, the ant is warm and well fed. The grasshopper with no food or shelter dies out in the cold. Recall the mind-set of the Grasshopper: I cannot understand why everyone else is working. They should follow my example and have a good time. Everyone is born with the same two basic choices. Put off working on improving your health long enough and one day it will indeed be too late to start. While we all would like to think that it is never too late to start a health program, just like in the late stages of starvation, there is in fact a point of no return. So, the sooner the Natural Health Perspective health program, or natural therapies , are started the better. The healing power of nature works, but requires time to work. George Burns almost made it to but he smoked cigars, drank alcohol and was not a health nut. How do you account for his longevity and others like him? George Burns was more athletic than you think he was. And he was a very social man--he loved people, he enjoyed life. He worked at living. Old George was a social lion, he got around and did things. It starts with your brain. Some people,

when they get to 60 years old have no interests anymore, have no friends left. George Burns was busy all the time doing something. The Holistic Health Magazine Realistically, you can be soft and gentle to yourself only for so long. An off-again and on-again health program wont increase your longevity. Keep on putting off a serious effort at improving your health and longevity, and it will one day be to your peril. Optimum natural health is obtained by addressing five key areas: Optimum longevity is obtained by taking these five natural therapies seriously. Introducing Longevity Antiaging Therapy Comments: Sustained change in dietary behaviour, promoted by long interventions, is probably necessary to achieve reduction in cardiovascular events Dietary fat intake and prevention of cardiovascular disease. Commonly observed combinations of diet, exercise, body mass index, past smoking habits, Conclusions Choices regarding diet, exercise, cigarette smoking, body weight Ten Years of Life: Is It a Matter of Choice?

2: Ozone Sauna Longevity Package - Steam Ozone Saunas - Longevity Resources

Longevity Rehab Center ensures high-quality and compassionate care. Our Home health Care program goes above and beyond, designed to bring personalized Physical Therapy services to individuals in the comfort of their own home.

Hormonal Therapies The levels of many hormones go down with age. Some of the oldest and still most popular anti-aging treatments are thus based on the notion that hormonal changes contribute to aging and reversing age-related hormonal changes will be beneficial. The most famous of these treatments involves human growth hormone hGH injections. Growth hormone has a long history as an anti-aging treatment and some evidence suggests hGH has beneficial effects in elderly people. There are studies in elderly patients in which they claim to feel younger after hGH treatment. While hGH was once hailed as a major breakthrough, like many other anti-aging products it failed to live up to expectations, in part because of its negative side-effects Liu et al. These might include weight gain, high blood pressure and diabetes. Because, as the name implies, hGH stimulates growth, concerns have also been raised as to whether hGH could stimulate cancer growth and whether it will contribute to cancer development in patients with existing malignant or pre-malignant tumors. Studies in mice do not by and large suggest a beneficial role for GH. If any, they suggest a harmful role. Though one study found that a low-dose GH therapy increases lifespan in aged mice Khansari and Gustad, mice genetically modified to produce lots of GH live less than controls while mice producing less GH live longer Coschigano et al. Of course, as mentioned above, studies in animals are not always relevant to human biology. Nonetheless, the results in mice suggest that higher GH levels will not make you live longer. Studies in humans with a deficiency in GH signalling due to a defect in the GH receptor also suggest a strong cancer protection due to decreased GH signalling Guevara-Aguirre et al. The human studies also hint at a sort of supernova effect: In conclusion, hGH might be useful in certain aged patients, for example its use has been suggested in cases of depression, but by and large it should be seen as cocaine for granddad. Lastly, I should point out that there are young patients with GH deficiency that if untreated have a reduced longevity Besson et al. Insulin-like growth factor 1 IGF-1 is another hormone that may play a role in aging and can be purchased as a supplement. In fact, there is some evidence that little people with low levels of IGF-1 live longer Krzysnik et al. Interestingly, anti-aging therapies based on lowering IGF-1 may be possible Miller, As mentioned elsewhere, IGF-1 does appear to play a role in aging, but whether it can be used in anti-aging is pure speculation at this stage. Clearly, however, IGF-1 injections are unlikely to extend lifespan and, like hGH, may even be harmful. Other hormones whose production decreases with age include DHEA and melatonin. DHEA has been reported to improve the wellbeing of the elderly by a variety of ways: Protection against cancer has also been argued but there is really no strong scientific evidence for this. Minor side effects such as acne have also been reported. Melatonin is a hormone mostly involved in sleep and circadian rhythms, the latter hypothesized by some to be associated with aging and life-extension Froy and Miskin, ; Kondratov, It appears to have antioxidant functions--more about antioxidants below--in the brain and may have some beneficial effects in elderly patients in particular in terms of sleep Poeggeler, Some of its proponents claim it delays the aging process and many age-related diseases, though this is far from proven. In mice, melatonin can increase lifespan but also appears to increase cancer incidence Anisimov et al. In humans there is no data to determine whether melatonin extends longevity, though it might have benefits in some patients Karasek, Although it can be used for jet lag and some sleep disorders, it may also cause sleep disorders such as nightmares and vivid dreams. One study claimed that melatonin levels do not decrease with age, except maybe at night, although due to diseases or drugs elderly persons can have low levels of melatonin Zhao et al. Melatonin may also aggravate asthma. Finally, for women, estrogen is a popular anti-aging therapy. This hormone is generally used in conjunction with others in hormone replacement therapy. It does appear to reduce some of the effects of menopause by protecting against heart disease and osteoporosis. On the other hand, it could increase risk of breast cancer and may lead to weight gain and thrombosis as side effects. There is a vast literature on the advantages and disadvantages of hormone replacement therapy, though this is outside the scope of senescence. In the context of aging, there is no evidence that estrogen is a viable

anti-aging therapy. For men, testosterone has also been touted as anti-aging but, again, there is no evidence it has anti-aging benefits even if it might have some benefits like, say, increased sexual function and muscle mass reviewed in Dominguez et al. Antioxidants One theory of aging is the free radical theory of aging. Succinctly, when oxygen is used to make energy in human cells, it releases reactive compounds called free radicals, also called reactive oxygen species ROS. To fight ROS, cells possess an array of defenses called antioxidants, many of which can be synthesized or extracted, purified, and then sold, generally in tablets, as anti-aging drugs Ames et al. Common antioxidants include vitamins A, C, and E and coenzyme Q Unfortunately, there is little evidence any of these products actually work. In mice, for instance, many studies indicate that antioxidants do not slow aging although they can at times slightly increase longevity Harman, ; Comfort et al. Vitamin C supplementation, for instance, does not affect lifespan in mice Selman et al. Resveratrol, which is discussed in more detail elsewhere , and other red wine constituents can also act as antioxidants Pervaiz, and might be protective agents of brain aging Tredici et al. So antioxidants might be healthy in the same way vitamin supplements, often including antioxidants, may be healthy; on the other hand, one large study found no evidence that multivitamin use influences mortality Park et al. There is little evidence that these products have serious side-effects, though one study found that antioxidants can accelerate cancer development in mice Sayin et al. Overall, there is no proof that antioxidants delay aging and some large-scale epidemiological studies even report that antioxidant supplements may actually increase mortality Bjelakovic et al. Since one major source of ROS are mitochondria, a similar class of compounds are aimed at quenching ROS production in mitochondria. These can include not only antioxidants but products that allegedly "rejuvenate" mitochondria by optimizing metabolism or membrane potential. Like for many other products, however, none of these products has been proven to have any effect on aging, either in animal models or in humans. Telomere-Based Therapies Telomerase is an enzyme that, at least in some cell lines, appears to overcome cellular senescence by extending the tips of the chromosomes called the telomeres--for more details please see another essay. Some have argued that if telomerase can avoid aging in cells in vitro, maybe it can be used to combat human aging Fossel, A number of companies and labs are developing telomerase-based therapies to fight aging and at least one product, a natural product-derived telomerase activator called TA, is already available. One study reported that taking TA may result in a decline of senescent immune system cells in patients Harley et al. TA can also increase telomerase levels in some mouse tissues and was reported to improve some health indicators in mice but it did not increase mean or maximum lifespan de Jesus et al. Even though our knowledge of telomerase is still imperfect, I am skeptical such therapies will succeed de Magalhaes and Toussaint, a. Firstly, as detailed elsewhere , mice expressing lots of telomerase do not live longer. Moreover, telomerase is important in cellular proliferation yet many of our organs, such as the brain, are mostly composed of cells that do not proliferate. Hence, telomerase will do little to alleviate aging in these tissues. Lastly, there is ample evidence telomerase favors tumorigenesis and so telomerase-based therapies may foster cancer development. Although research on telomerase is still in an early age, I have doubts about the efficiency and long-term safety of telomerase-based anti-aging therapies. The fact that TA can increase telomerase levels but does not extend lifespan in mice de Jesus et al. One high-profile study showed that telomerase reactivation reverses degeneration in mice Jaskelioff et al. However, this study was conducted in animals that have no telomerase to begin with and thus develop a number of pathologies. Benefits from reactivating telomerase in mice that become sick for lack of telomerase are hardly surprising. Some companies are also selling telomere measurements to estimate biological age. Although telomere shortening may be a marker of certain diseases, there is no evidence at present that telomere length is a better indicator of biological age than chronological age. Stem Cells In recent years stem cells have received widespread attention. This fame is partly merited given the huge potential of stem cells for regenerative medicine, as discussed elsewhere. The possibility of using stem cells to treat diseases of aging and for rejuvenation is also tantalizing. In some areas indeed stem cells have been shown to be useful. For example, blood- and marrow-derived stem cells have been used successfully in some autoimmune and cardiovascular diseases reviewed in Burt et al. Interestingly, mesenchymal stem cells transplanted from young donors extends lifespan in mice Shen et al. Yet stem cell applications are still in their infancy and a long way before

physicians can employ stem cells to delay aging. It acts by catalytically breaking AGE crosslinks: Advanced Glycosylation End-product crosslinks occur when glucose is attached to a protein, like it can happen in arteries. For this, ALT seems to be useful against heart disease by reducing pulse pressure and improving arterial elasticity. In one small clinical trial rapamycin ameliorated immunosenescence in elderly volunteers Mannick et al. Rapamycin is also an immunosuppressant, used to prevent organ rejection, with serious side-effects and so it is not suitable as an anti-aging drug. However, rapamycin works by inhibiting a complex pathway called TOR Target of Rapamycin and a number of labs and companies are now trying to target more specific downstream nodes of the pathway to develop anti-aging drugs without the side-effects of rapamycin reviewed in de Magalhaes et al. One gene that appears to influence aging in mice is klotho. Human longevity has also been linked to allelic variants in this gene Arking et al. Its functions are still largely a mystery but since the gene encodes one secreted form that acts as a hormone, it could be synthesized and presented as an anti-aging therapy. For now, however, we will just have to wait and see. There are many other aging-associated genes that hold promise for pharmaceutical intervention, and progress has been made in finding chemicals that can modulate specific aging-associated genes and thus extend lifespan Ja et al. On average, however, it takes 12 years from discovery of molecular mechanisms to develop a drug, plus 10 years of tests to make a drug available. In the case of aging the timescale may be longer, though many companies trying to develop anti-aging products are focusing on specific age-related diseases as a way to overcome the legal barriers of a product targeting aging de Magalhaes et al. But that is not to say there are not simple lifestyle and dietary adjustments that can make you live longer. Most components of a healthy lifestyle are well-known already, and I will be just stating the obvious. Still, a varied, rich diet with plenty of fruits and vegetables and low in carbohydrates and fat is likely to make you live longer. As an example, look at the Okinawan population in Japan in which older individuals have a lower risk of age-related chronic diseases and mortality when compared to the rest of Japan. Okinawans tend to avoid high calories sugars, saturated fats and processed foods and instead consume more vegetables and fruits, which has likely contribute to their long lifespan Willcox et al. Conversely, smoking, excess alcohol, obesity, lack of exercise and high blood pressure are all associated with higher mortality. One study showed that middle aged years of age people who adopted a healthy lifestyle by consuming five or more fruits and vegetables daily, regular exercise, healthy body mass index BMI

3: Life extension - Wikipedia

Longevity Physical Therapy is a full-service physical therapy and training center specializing in the practice of Applied Functional Science.

February 20, Telomeres and aging: Telomeres are short DNA segments located at the end of all chromosomes. They are synthesized by an enzyme called telomerase [1]. Telomeres have become a subject of interest in the fight against aging since a correlation was found between telomere shortening and biological aging. This shortening happens during cell division, but many other factors can accelerate the process gender, stress, smoking, drinking, obesityâ€¦ Telomeres seem to be at the heart of the fight against aging, given the close bond between the two. Telomere length then becomes an interesting lead to elaborate therapies and solutions to fight against aging. As of now, no therapy has proven its efficiency to fight telomere shortening and lengthen the human lifespan, but a few studies have been conducted and there are methods to gain a longer lifespan and a better health by targeting telomeres. An anti-aging gene therapy targeting telomerase Experiments were conducted on mice by Spanish researchers in order to lengthen the mice healthspan and lifespan as they aged [3]. The goal of the experiment was to treat adult mice 1 year old and aged mice 2 years old by injecting them with an adeno-associated virus AAV that can synthesize mice telomerase through the TERT protein telomerase reverse transcriptase. Their lifespan and general health were then compared to those of healthy mice of the same age. In fact, the ability to synthesize telomeres in excess triggers an excess of cell divisions, and might even make them last indefinitely, which would create immortal cells, that would become malignant tumors when the immortal cells began to proliferate. Those results tell us that this telomerase therapy allows to push back the limits of a mouse lifespan and healthspan. It could be an efficient anti-aging therapy on mice, and potentially on other mammals and even humans in the future. Lifestyle changes to fight telomere shortening and aging Although no therapy was proven to work on humans, some behaviors and lifestyle changes can prevent telomere shortening. According to a study by Massod A. Shamas, from the Cancer Institute in Boston, many proofs tend to confirm that lifestyle affects health and lifespan, and directly affect telomere length [4] Here are a few factors that can effect health and lifespan according to that study, and the beneficial habits that can favour longer telomeres: Excess weight and obesity favour shorter telomeres Excess weight and obesity trigger an increase in oxidative stress, because of an unregulated adipocytokine production, and due to the production of oxidative agents in adipose tissue. Oxidative stress can cause DNA damage, and is very much likely to trigger telomere shortening, which induces a shorter lifespan by 8,8 years [4]. A diet can be changed as well: Thanks to experiments on rats, it was proven that caloric restriction can reduce oxidative stress and thus DNA damage. Eating antioxidant-rich foods can prevent telomere shortening According to a study, food rich in omega-3 type fatty acids which are antioxidants is associated to slower telomere shortening: After 5 years, a correlation was found between higher levels of those fatty acids and longer telomeres. The higher the antioxidant intake is, the less telomere shortening can be observed [4]. At last, eating fiber can be more recommended than fat and proteins. Still with experiments on rats, a positive correlation was found between long telomeres and a fiber-rich diet. Smoking increases telomere shortening and aging: Smoking a pack of cigarettes on a daily basis is linked to the loss of about 25,7 to 27,7 bp base pairs of telomeres a year, due to the considerable increase in oxidative stress caused by tobacco. Over 40 years, this equals to 7,4 years of lifespan loss. This is why smoking less matters, and stopping also helps limit telomeric DNA loss and slow down aging, or opting for an anti-oxidative therapy to reduce oxidative stress [4]. Stress has a direct effect on telomere length: Stress releases hormones that block the anti-oxidant proteins in the body, which leads to a higher oxidative stress that in turn induces telomere shortening and lower telomerase activity. Stress could be responsible for as much as a 10 year loss in life expectancy. This is why it is paramount to pay attention to external sources of stress and to lifestyle habits in order to fight against aging [4]. There are anti-aging therapies, efficient on mammals, that directly affect telomeres. It is also possible to preserve your telomeres with lifestyle changes. Although no gene therapy has scientifically proven its efficiency on humans yet, there seems to be promising leads and we can only wait for real scientific studies

and preclinical trials in order to adapt them. However, other causes of aging remain to be tackled before we can get to comprehensive anti-aging therapies.

4: Part 5: Fight aging with telomere therapy - Work for human longevity

Longevity Physical Therapy, Carlsbad, California. likes · 26 talking about this · were here. Longevity PT uses a whole body approach to treat.

In the fable, after a lengthy debate between those who believe the dragon is a fact of life and those who believe the dragon can and should be destroyed, the dragon is finally killed. Bostrom argues that political inaction allowed many preventable human deaths to occur. Aging as a disease[edit] Mainstream medical organizations and practitioners do not consider aging to be a disease. Moody, director of academic affairs for AARP , notes that what is normal and what is disease strongly depend on a historical context. Perlman, coined the terms "aging syndrome" and "disease complex" in to describe aging. One view is, this would stimulate pharmaceutical companies to develop life extension therapies and in the United States of America, it would also increase the regulation of the anti-aging market by the FDA. Anti-aging now falls under the regulations for cosmetic medicine which are less tight than those for drugs. Since , investigators have found ways to increase the lifespan of nematode worms and yeast by fold; the record in nematodes was achieved through genetic engineering and the extension in yeast by a combination of genetic engineering and caloric restriction. Longevity gains from dietary restriction, or from mutations studied previously, yield smaller benefits to Drosophila than to nematodes, and smaller still to mammals. From an evolutionary perspective, mammals and their ancestors have already undergone several hundred million years of natural selection favoring traits that could directly or indirectly favor increased longevity, and may thus have already settled on gene sequences that promote lifespan. Moreover, the very notion of a "life-extension factor" that could apply across taxa presumes a linear response rarely seen in biology. Some drugs that are already approved for other uses have been studied for possible longevity effects on laboratory animals because of a possible CR-mimic effect; they include rapamycin , [69] metformin and other geroprotectors. One notable direction of research has been research into the possibility of using the enzyme telomerase in order to counter the process of telomere shortening. Eric Drexler , one of the founders of nanotechnology , postulated cell repair machines, including ones operating within cells and utilizing as yet hypothetical molecular computers , in his book Engines of Creation. Raymond Kurzweil , a futurist and transhumanist , stated in his book The Singularity Is Near that he believes that advanced medical nanorobotics could completely remedy the effects of aging by Hibbs suggested that certain repair machines might one day be reduced in size to the point that it would, in theory, be possible to as Feynman put it " swallow the doctor ". Recently, the US Department of Defense initiated a program to research the possibility of growing human body parts on mice. Dog and primate brain transplantation experiments were conducted in the mid 20th century but failed due to rejection and the inability to restore nerve connections. The use of human stem cells , particularly embryonic stem cells , is controversial. Use of stem cells taken from the umbilical cord or parts of the adult body may not provoke controversy. Some proponents of therapeutic cloning predict the production of whole bodies, lacking consciousness, for eventual brain transplantation. Cyborg Replacement of biological susceptible to diseases organs with mechanical ones could extend life. This is the goal of the Initiative. Cryonics For cryonicists advocates of cryopreservation , storing the body at low temperatures after death may provide an "ambulance" into a future in which advanced medical technologies may allow resuscitation and repair. They speculate cryogenic temperatures will minimize changes in biological tissue for many years, giving the medical community ample time to cure all disease, rejuvenate the aged and repair any damage that is caused by the cryopreservation process. Many cryonicists do not believe that legal death is " real death " because stoppage of heartbeat and breathing "the usual medical criteria for legal death" occur before biological death of cells and tissues of the body. Even at room temperature , cells may take hours to die and days to decompose. Although neurological damage occurs within 4-6 minutes of cardiac arrest, the irreversible neurodegenerative processes do not manifest for hours. People, particularly children, have survived up to an hour without heartbeat after submersion in ice water. In one case, full recovery was reported after 45 minutes underwater. Resuscitation of a postembryonic human from cryonics is not possible with current science. Some scientists still support the idea based on their

expectations of the capabilities of future science. Strategies for Engineered Negligible Senescence and Genetics of aging Another proposed life extension technology would combine existing and predicted future biochemical and genetic techniques. SENS proposes that rejuvenation may be obtained by removing aging damage via the use of stem cells and tissue engineering , telomere -lengthening machinery, allotopic expression of mitochondrial proteins, targeted ablation of cells, immunotherapeutic clearance, and novel lysosomal hydrolases. Genome editing Genome editing , in which nucleic acid polymers are delivered as a drug and are either expressed as proteins, interfere with the expression of proteins, or correct genetic mutations, has been proposed as a future strategy to prevent aging. The basic idea is that our bodies are composed of genes that activate throughout our lifetimes, some when we are young and others when we are older. Presumably, these genes are activated by environmental factors, and the changes caused by these genes activating can be lethal. It is a statistical certainty that we possess more lethal genes that activate in later life than in early life. Therefore, to extend life, we should be able to prevent these genes from switching on, and we should be able to do so by "identifying changes in the internal chemical environment of a body that take place during aging Mind uploading One hypothetical future strategy that, as some suggest,[who? The basic idea is to scan the structure of a particular brain in detail, and then construct a software model of it that is so faithful to the original that, when run on appropriate hardware, it will behave in essentially the same way as the original brain. Some scientists believe that the dead may one day be "resurrected" through simulation technology. Young blood transfusion Some clinics currently offer injection of blood products from young donors. The alleged benefits of the treatment, none of which have been demonstrated in a proper study, include a longer life, darker hair, better memory, better sleep, curing heart diseases, diabetes and Alzheimer. Karmazin has not published in any peer-reviewed journal and his current study does not use a control group.

5: Researchers Study 3 Promising Anti-Aging Therapies - Scientific American

Longevity Physical Therapy is the premier physical therapy clinic in San Diego. We strive to restore function, enhance mobility, and amplify your performance. Physical therapy isn't just for recovering athletes.

Victo Ngai Advertisement The majority of older Americans live out their final years with at least one or two chronic ailments, such as arthritis, diabetes, heart disease or stroke. The longer their body clock ticks, the more disabling conditions they face. Doctors and drug companies traditionally treat each of these aging-related diseases as it arises. But a small group of scientists have begun championing a bold new approach. Studies of centenarians suggest the feat is achievable. Most of these individuals live that long because they have somehow avoided most of the diseases that burden other folks in their 70s and 80s, says Nir Barzilai, director of the Institute for Aging Research at the Albert Einstein College of Medicine. For them, illness typically starts later and arrives closer to the end. Researchers have already developed various techniques to increase the life span of yeast, worms, flies, rats and perhaps monkeys. Adapting these measures to people seems like the next logical step. Delaying the aging process by even a few years could offer enormous social benefits as populations around the globe grow increasingly older. Census Bureau estimates that one in five Americans will be older than 65 by 2050, up from one in seven in 2000. In an estimated 44 million people around the world suffered from dementia. That number is expected to jump to nearly 76 million in 2050, with not nearly enough younger people in a position to be able to take care of them. Among the handful of approaches that researchers are studying, three stand out. Evidence Of course, to conclusively determine whether a treatment works, investigators need a definition of aging and a way to measure the process. If a kidney cell divided yesterday, is it one day old or as old as the person in whom it resides? Still, research over the past decade has offered several hints that the damaging aspects of aging—however you define it—can be slowed. In a study, Thomas Rando, director of the Paul F. Glenn Center for the Biology of Aging at Stanford University, showed that an elderly mouse whose bloodstream was surgically linked to a young mouse recovered its youthful wound-healing powers. Harvard University biologist Amy Wagers has since found a protein, dubbed GDF11, in the blood that may have contributed to the faster healing. Her experiments, published in *Science* in 2012, found more of the protein in younger mice than in older ones; when injected in older mice, GDF11 appeared to restore muscles to their youthful structure and strength. A new study, in *Cell Metabolism*, calls that finding into question, however, suggesting that GDF11 increases with age and may even inhibit muscle restoration and that some other factor must make the cells act younger. A second approach consists of examining about 20 currently existing medications and nutritional supplements at a level of detail that has never before been possible to see whether they might actually affect the aging process. For example, researchers at Cardiff University in Wales and their colleagues reported in 2013 that patients with type 2 diabetes who took the drug metformin lived, on average, 15 percent longer than a group of healthy people who did not suffer from the metabolic disorder but were similar in nearly all other respects. Scientists speculate that metformin interferes with a normal aging process, called glycation, in which glucose combines with proteins and other important molecules, gumming up their normal workings. The metformin finding is particularly striking because people who have diabetes, even if it is well controlled, typically have somewhat shorter life spans than their healthy counterparts. Meanwhile, in a study of adults published late last year in *Science Translational Medicine* researchers at pharmaceutical company Novartis showed that a compound called everolimus, which is chemically similar to rapamycin a drug used to prevent kidney rejection in transplants, improved the effectiveness of the flu shot in people older than 65. As individuals age, their immune systems do not mount as strong an antibody response to the inactivated virus in the vaccine as they once did; thus, older people are more likely to get sick if they later encounter a real flu virus. Tests showed that study patients given everolimus had a higher concentration of germ-fighting antibodies in their blood than their untreated counterparts. As with any drug, side effects were an issue. Members of the treated group were more likely to develop ulcers in their mouth, which may limit the widespread usefulness of the medication for treating aging. Cost may be another factor; everolimus, which was approved by the U.S. FDA in 2009, is expensive. Nevertheless, the results support the

idea that aging can be slowed. Indeed, everolimus and other rapamycinlike drugs have been shown to dramatically extend the life span of mice, preventing diseases such as cancer and reversing age-related changes to the blood, liver, metabolism and immune system. A third, completely different approach involves diet. Restricting the consumption of calories was long ago shown to help mice to live longer. Whether limiting food intake without causing malnutrition might benefit humans as well is not so clear. For one thing, very few people can or want to maintain such low-calorie diets for the decades needed to prove definitively that this approach works. But it may turn out that such drastic steps are unnecessary. Valter Longo, director of the Longevity Institute at the University of Southern California, has shown that he can extend the life span of mice merely by limiting their food on alternate days or by cutting down on the amount of protein they consume. Such intermittent fasting may turn out to be more palatable for people, although its benefits remain unproved. Caveats Living longer may come with trade-offs. Making old cells young again will mean they will start dividing again. Controlled cell division equals youthfulness; uncontrolled cell division equals cancer. But at the moment, scientists are not sure if they can do one without the other. Figuring out the right timing for treatment is also complicated. If the goal is to prevent multiple diseases of aging, do you start your antiaging therapies when the first disease hits? So it probably makes more sense to start treatment years earlier, during a healthy middle age. But the research needed to prove that supposition would take decades. If various diseases can be pushed off, the next obvious question is by how long. Scientists have successfully extended the life span of worms eightfold and added a year of life to three-year-old lab mice. Would these advances translate into an year-old person living five or six centuries or even an extra 30 years? Or would they get just one more year? Life extension in people is likely to be more modest than in yeast, worms, flies or mice, Rando says. Previous research has suggested that lower-order creatures benefit the most from longevity efforts—“with yeast, for instance, deriving a greater benefit in caloric-restriction experiments than mammals. And what magnitude of benefit would someone need to justify taking—and paying for—such a treatment? What, if anything, do antiaging investigators themselves do to try to slow their own aging? The half a dozen scientists interviewed for this article all said that they make concerted efforts to extend their own life span. One was grateful for a diagnosis of prediabetes, which meant a legitimate prescription for metformin. The research is getting so solid, Kennedy says, that he is having a tougher time convincing himself not to take some drugs than to take them. All the experts say they try to live healthy lives, aside from enduring high-pressured jobs. They try to get close to eight hours of sleep, eat moderate amounts of nutritious foods and get lots of exercise. None of them smokes. Most Americans, unfortunately, do not follow such healthy habits. The greatest irony would be to discover that a pill is not, in the end, any more effective than the healthy habits we already ignore. This article was originally published with the title "Can We Stop Aging?"

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